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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/606,894	06/27/2003	Yukio Inazuki	0171-0983P	6145

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EXAMINER	
ROSASCO, STEPHEN D	
ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 05/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/606,894	INAZUKI ET AL.	
	Examiner	Art Unit	
	Stephen Rosasco	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/27/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

The disclosure is objected to because of the following informalities: at the beginning of the specification a statement is required that this application is a Divisional of U.S. Patent Application Serial No. 10/212,113, which is now abandoned. Page 13, line 12, the number is missing after Example.

Appropriate correction is required.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Angelopoulos et al. (6,653,027) in view of Ikuta (US 20030003616 A1) and Andreas (6,635,562).

The claimed invention is directed to a method of manufacturing a phase shift mask blank comprising a transparent substrate and at least one layer of phase shift film thereon, said method comprising the steps of forming the phase shift film on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the phase shift film is a metal silicide oxide, metal silicide nitride or metal silicide oxynitride on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the metal is molybdenum.

The applicant also states that one important feature for these phase shift masks and phase shift mask blanks is resistance to acids, for example, chemical liquids such as sulfuric acid and aqueous persulfuric acid (mixture of sulfuric acid and aqueous hydrogen peroxide) used in the resist removing and cleaning steps of the mask manufacture process, and chromium etchants having a high oxidizing power used in removal of chromium film.

[0012] Prior art phase shift films are less resistant to chemical liquids and raise a problem that the cleaning or chromium etching step results in deviations of phase difference and transmittance from the preset values.

Angelopoulos et al. teach a method of fabricating an attenuating phase shift mask blank for use in lithography comprising: providing a substrate; disposing a thin layer of phase shifting layer on said substrate; forming a surface layer rich in oxygen on said phase shifting layer; wherein said blank is capable of producing a photomask with 180 degree phase shift and an optical transmission of at least 0.001% at a selected wavelenth; and said surface layer rich in oxygen is obtained by oxygen plasma bombardment.

Angelopoulos et al. also teach (see abstract) an attenuating embedded phase shift photomask blank that produces a phase shift of the transmitted light is formed with an optically translucent film made of metal, silicon, nitrogen or metal, silicon, nitrogen and oxygen. A wide range of optical transmission (0.001% up to 20% at 193 nm) is obtained by this process. A post deposition process is implemented to obtain the desired properties (stability of optical properties with respect to laser irradiation and acid treatment) for use in industry. A special fabrication process for the sputter target is implemented to lower the defects of the film.

And further (col. 2, lines 5-11) that when the phase shift mask or phase shift mask blank is annealed to a temperature higher than room temperature under an atmosphere which contains oxygen at more than 10 sup.-3 torr partial pressure, a film structure can be produced that is stable against photon irradiation and chemical treatments for photomask fabrication.

The teachings of Angelopoulos et al differ from those of the applicant in that the applicant teaches surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

Ikuta teaches a method of manufacturing a thin-film transistor comprising: bringing a surface of a semiconductor film formed on a substrate into contact with ozone-containing water to form a surface-oxidized layer on the surface, forming a predetermined pattern mask on the semiconductor film, carrying out either of processes selected from etching and impurity ion implantation by using the mask,

and removing the mask with the surface-oxidized layer being formed at least on an exposed portion of the surface of the semiconductor film.

Ikuta also teaches by oxidizing the surface of the polysilicon film 2, a surface-oxidized layer 3 with a thickness of about 1 to 5 nm is formed (FIG. 1(b)). In the formation of the surface-oxidized layer, water in which ozone is dissolved (ozone water) is used. The use of ozone water enables the formation of the surface-oxidized layer 3 having excellent uniformity in thickness over the entire surface of the substrate without damaging the polysilicon film 2. Moreover, the oxidation with ozone water can be carried out at low cost. Furthermore, since ozone water has a washing effect as well, it is possible to remove dirt such as microparticles on the surface of the substrate. For example, ozone water may be dripped onto the surface of the polysilicon film while rotating the substrate.

Andreas teaches (col. 6, line 66 to col. 7, line 15) in a method for treating an aluminum surface, that oxidants may also be added to the cleaning solution or applied to the polished wafer directly after polishing and before subsequent cleaning steps. Preferably, the oxidant(s) is applied to the polished wafer directly after polishing and before subsequent cleaning steps. Oxidants help the cleaning solution maintain the passivative environment which protects the exposed metal or aluminum structures. In particular, when aluminum surfaces are exposed to water, the oxidants create and preserve a thin, continuous layer of hydrated aluminum oxide at the aluminum-water interface. Oxidants that may be added to the cleaning

solution include ozone, hydrogen peroxide, peroxy salts, ammonium persulfate, and the like, or mixtures thereof. Preferably, ozone is used as the oxidant. A DI water solution containing about 1 to about 20 ppm ozone, preferably about 10 ppm, may be employed on the polisher during a final polish rinse step which may last about 30 seconds.

It would have been obvious to one having ordinary skill in the art to take the teachings of Angelopoulos et al. and combine them with the teachings of Ikuta and Andreas in order to make the claimed invention because all the references teach the protection benefits of forming an oxide layer on a surface that is to be exposed to a manufacturing environment, Angelopoulos teach the mask materials and the benefits of oxygen treatment of the surface of the substrate, Ikuta teach the method of oxidizing the surface of a polysilicon film with an aqueous ozone solution, and Andreas teachs the aqueous ozone solution concentrations as recited in the claimed invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Rosasco
Primary Examiner
Art Unit 1756

S.Rosasco
04/27/05